

# PATENT SPECIFICATION

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## (54) IMPROVEMENTS IN OR RELATING TO CONTROL DEVICES

(71) We, STANDARD TELEPHONES AND CABLES LIMITED, a British Company of 190 Strand, London W.C.2., England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a man/machine interface, especially suitable for use by a disabled person, which uses optical coupling to the human eye.

According to the present invention there is provided an electro-optical man-machine interface arrangement, which includes a television camera aimed at an operator's eye such as to produce an image of that, an eye recognition circuit which identifies the eye on the image and so controls the zoom circuitry of the camera as to get a large image of the eye, a shape analyser which examines the image and assesses from the shape of the iris of the eye as presented on the image the direction in which the operator is looking, and means responsive to the determination of the direction in which the operator is looking to control a control element of the machine with which the arrangement is to be used.

The human eye is a relatively simple geometric structure, consistent in shape, size and colour contrast. Even when partly obscured by an eyelid it is possible to determine the direction in which the eye is looking by analysis of the shape of the visible iris. When viewed directly along the line of sight the iris is circular. When viewed from other angles the iris is elliptical, the major and minor axes being dependent on the direction of vision and viewing angle.

A human being can determine the direction in which another human is looking by analysis of this simple shape. This is possible with some accuracy even when the

two persons are considerable distances apart. Television cameras are available with considerably better resolution than that of the human eye, and by analysing the picture produced by a T.V. camera it is possible to determine electronically the precise line of sight of the observed eye.

An embodiment of the invention will now be described with reference to the accompanying drawing, the upper part of which is a block diagram of a system embodying the invention, while the other part is explanatory.

In Fig. 1, it will be seen that a TV camera 1 is aimed at the operator's eye 2, and the analysis of the T.V. image of the eye is performed in two stages:

1) By an eye recognition circuit 2 is fed from the camera 3 via a scanner 4, and which identifies the eyeball. It also controls the zoom facility via the connection 5 on the camera so that the image of the eye fills the picture.

2) The eyeball is now examined by the iris shape analyser 6 to determine the line of sight of the eyeball.

If this information is used to determine the X-Y coordinates of an X-Y plotter 7, or alternatively the position of a dot on a T.V. screen, the operator can cause writing on the screen by movement of the eye, precise control being achieved due to the feedback-loop as shown.

If the output of the analysed information is used to inform a keyboard or typeface of the character being observed then character selection may be made optically.

If the output of the analysed information is used to produce mechanical movement then an optically coupled remote control is achieved.

### WHAT WE CLAIM IS:—

1. An electro-optical man-machine interface arrangement, which includes a television camera aimed at an operator's eye such as

to produce an image of that eye, an eye  
recognition circuit which identifies the eye  
on the image and so controls the zoom  
circuitry of the camera as to get a large  
5 image of the eye, a shape analyser which  
examines the image and assesses from the  
shape of the iris of the eye as presented  
on the image the direction in which the  
operator is looking, and means responsive  
10 to the determination of the direction in

which the operator is looking to control a  
control element of the machine with which  
the arrangement is to be used.

2. An electro-optical man-machine inter-  
face arrangement, substantially as described 15  
with reference to the accompanying draw-  
ing.

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the Original on a reduced scale*

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